REVIEWS OF BOOKS

GENETICS

Shields, James. *Monozygotic Twins Brought up Apart and Brought up Together.* Foreword by **Eliot Slater.** London 1962. Oxford University Press. Pp. x + 264. Price 50s.

GALTON FIRST DREW attention in 1875 to the value of twin studies in elucidating the importance of heredity. In 1925, fifty years later, Müller drew attention to the special value of identical twins reared apart when he reported a re-investigation of such a pair first described by Popenoe in 1922. The first series of such separated twins was reported by Newman, Freeman and Holzinger in 1937. Altogether, they found nineteen pairs reared apart and were able to add a twentieth pair in 1940. Since then only individual pairs have been reported until 1943 when Burt published correlations for Binet I.Q. for fifteen British pairs brought up apart.

The present series was collected following a B.B.C. appeal in a programme on twins in 1953. A total of forty-four identical pairs brought up apart were discovered and investigated; the great majority of them were interviewed by the author. Most of the pairs had been separated within six months of birth and not reunited until after they had left school. The investigation involved a personal interview, two intelligence tests, and the completion of a self-rating questionnaire for personality traits. Short biographies are given for each twin pair, and, in addition, there is an analysis of the intra-class correlations of the separated pairs for intelligence and two aspects of personality, introversion and extraversion, and neuroticism. The biggest contrast between the environments of any twin pair was in the case of a pair of identical twin girls one of whom had been brought up in a doctor's family in South America and the other by a Scandinavian ship's carpenter.

In the analyses the correlations for the separated identical twins were compared with those of a control group of identical twins, brought up together, and a small sample of fraternal twins, brought up together. On the intelligence test scores which consisted of a dominoes test and the synonym section of the Mill Hill vocabulary scale, the resemblance of the identical pairs brought up apart was as close as that of the identical pairs brought up together, 0·77 and 0·76; for the fraternal twin pairs brought up together, the correlation was 0·51. There was therefore no indication that the different upbringing of the separated twins had caused any difference in the development of their ability to do intelligence tests. For the introversion-extraversion dimension of personality the correlation for the separated pairs was 0·61 and for neuroticism the correlation was 0·53. For identical pairs brought up together, the corresponding correlations were 0·42 and 0·38. For these personality traits, then, the separated pairs were actually more alike than the pairs brought up together. This suggests that the very fact of identical pairs being brought up together causes them to become somewhat unlike in personality. While the correlations for the identical pairs brought up apart are a strong indication of the importance of genetic factors in the development of these aspects of personality. Dr. Shields supplemented the self-rating questionnaire by personal interview of the twin pairs in which he attempted to estimate their personality characteristics and, like the questionnaire results, his findings indicated an often remarkable resemblance in the personalities of the separated identical pairs.

This was a soundly planned survey, and it is well described. The reviewer is sorry that more emphasis was not given to the intellectual difference between the identical pairs brought up apart; but the emphasis on personality tests is understandable in a survey from a psychiatric unit. The author is able to conclude that differences in early family structure and upbringing do not stand out as important causes of differences in later personality or intelligence.

C. O. C.

Moran, P. A. P. *The Statistical Processes of Evolutionary Theory.* Oxford 1962. Clarendon Press: Oxford University Press. Pp. vii + 200. Price 38s.

PROFESSOR MORAN'S BOOK follows close

on the heels of *Introduction to the Mathematical Theory of Genetic Linkage,** by Dr. N. T. J. Bailey, from the same publisher, and these two books for mathematical geneticists are very similar in format. Unfortunately, however, the publishers have chosen to economize on the number of pages in Professor Moran's book by setting more lines to the page than in Dr. Bailey's, so that, even though it is a shorter work, it is less legibly set out. Though the printing (by the Aberdeen University Press) is good, it somehow misses that quality of excellent typography, especially in respect of mathematics, which is the hallmark of the Oxford University Press, the printers of Dr. Bailey's book.

A further contribution to the difficulty of digesting Professor Moran's work is the complete lack of subdivisions for the chapters. With only nine chapters, the author tends to wander from one subject to another with no dividing line between. The ordinary mortal of a reader finds himself assimilating the mathematics of one subject whilst his mind is still occupied with the problem of the last.

The author dives into his subject fast (achieving a differential equation by page three) by discussing population structure from the angle of birth rates, death rates, and age distributions, and proceeds, in the second chapter, to a deterministic account of random mating without mutation and selection, but with linkage and polyploidy. Chapter 3 introduces mutation and selection, but the treatment is still deterministic, and "statistical processes" only fully come into play in Chapter 4, on the approach to homozygosity, and the following chapters. In Chapter 5 there is a consideration of the probability of survival of a single mutant, and Chapters 6 and 7 treat haploid and diploid population models stochastically. Chapter 8 is a deterministic account of self-sterility, and Chapter 9 of spatial gene distributions ("Edge and corner effects could be obviated by wrapping the lattice around a torus"!).

It will be seen from this synopsis that the book is more a collection of particular topics than a systematic exposition of evolutionary theory.

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* See THE EUGENIC'S REVIEW, 1962, **54**, 90; for a notice by the present reviewer, see *Heredity*, 1962, **17**, 442.

No doubt this impression is generated by the impossibility of finding a desired topic; let the reader try to locate Fisher's fundamental theorem—it is not in the subject index, nor does the author index lead to it; the chapter headings are not much more helpful, but the mathematics is all there, somewhere. However, the chosen topics are well-treated, and the different writers of mathematical genetics, from Fisher to Kimura, well-translated. This is, of course, a mathematical treatise, but the mathematics is nowhere very advanced, although usually fairly heavy, as seems inevitable with this subject.

It is always difficult to pick up misprints in a book full of symbols, but on page 37 there seem to be some coefficients missing in the expression in the centre of the page, and on the following page the last of the three equations for the gametic output contains a misprint. The use of ln and log for natural logarithms is not consistent. Page 3 has "it" for "if" (second line from bottom), page 10 "different" for "difference" (bottom line), and page 187 the wrong date in Cotterman's reference (it should be 1953). The reader should be on his guard against further misprints.

This book should prove useful for mathematical geneticists to refer to, but, mainly due to bad presentation, the author fails in his "attempt to give a systematic account of the mathematical aspects of the genetics of natural populations." It should prove an excellent source for the writer of an advanced text-book on these difficult problems, but such a book is still needed.

A. W. F. EDWARDS

Auerbach, Charlotte. *Mutation: An Introduction to Research on Mutagenesis.* Part 1. Methods. Edinburgh 1962. Oliver and Boyd. Pp. xii + 176. Price 12s. 6d.

THIS BOOK IS essentially for the research worker but everyone with an interest in genetics, who therefore realizes the fundamental importance of the study of mutation, should look at this careful account of the methods used, if only to be humbled by the extent and complexity of the work already done in this field. Hereditary changes in the cytoplasm are only now being